

REMARKS — General

By the above amendment, Applicants have amended the claims to define the invention more particularly and distinctly so as to overcome the technical rejections and define the invention patentably over the prior art.

The Rejection Of The Claims Under § 102

1. The last O.A. rejected claims 1, 3, 6-7, and 9-12, under 35 U.S.C. 102(b) as being anticipated by Maurer, et al., US 6,272,231 B1 (hereinafter Maurer).

Applicants amended the claims as follows:

The Rejection Of Claim 1 On Maurer Overcome

2. Applicants respectfully request reconsideration of the rejection, as now applicable to the currently amended claim 1, for the following reasons:

Novel and unobvious approaches in applicants' system are clearly foreign to Maurer. The non-trivial differences clearly show the novelty and unobviousness of the present invention over the prior art. The differences in the fundamental approaches are discussed in the following at least three points.

(1) Determination of the race and gender of a person in the images is foreign to Maurer.

(2) Selection of a face model specific to the demographic recognition of the person as an approximate face model is foreign to Maurer.

(3) Combination of demographic recognition with affine coordinate based mesh adjustment technique face modeling is foreign to Maurer.

Determination Of The Race And Gender Of A Person In The Images Is Foreign To Maurer

3. In paragraph 3 of the last O.A., the O.A. noted that “The bunch graph is matched with the image that is taken, and since the bunch graph itself can contain thousands of facial images with different defined positions called landmarks, the match determined between the bunch graph and the image taken will give an output of the correct race and gender based upon the specific landmarks for each demographic.”

Applicants respectfully disagree.

The note above is based on a guessed assumption that “the match determined between the bunch graph and the image taken **will give an output of the correct race and gender** based upon the specific landmarks for each demographic” because “the bunch graph itself can contain thousands of facial images with different defined positions called landmarks”.

However, this assumption above teaches a feature what Maurer did not teach, based on an interpreted guess about what the “bunch graph” can do. Maurer itself did not teach the race and gender determination using the “bunch graph”. It can be clearly understood that there is literally no explicit teaching for the race and gender determination in (Maurer, col. 5, lines 29-46) according to the disclosure.

Maurer mentioned race, age, and gender only once in (Maurer, col. 5, lines 29-46) out of the entire disclosure and only to explain that the, “bunch graph covers a great variety of faces that may have significantly different local properties,” i.e. to explain the capacity of the bunch graph that covers various faces with various local properties, as explicitly noted in, “When constructed using a judiciously selected gallery, a bunch graph covers a great variety of faces

that may have significantly different local properties, e.g., samples of male and female faces, and of persons of different ages or races.” (Maurer, col. 5, lines 42-46).

Maurer is clearly foreign to the idea of determining the race and gender of a person in the images. Maurer teaches the “bunch graph” as a data structure to represent a face that can cover various race and gender not to determine the race and gender of a person in the images as it is explicitly and clearly noted in (Maurer, col. 5, lines 29).

Whereas, applicants explicitly teach how to determine the race and gender of a person in the images, especially in consideration of three dimensional face modeling (Applicants’ specification, page 8, line 11 – page 9, line 4). The difference is non-trivial to those who are familiar with the subject matters in the practiced art.

Selection Of A Face Model Specific To The Demographic Recognition Of The Person As An Approximate Face Model Is Foreign To Maurer

4. In paragraph 3 of the last O.A., the O.A. noted that “the same place in the prior art, where selection of the best matched between the image and the bunch graph is selected. Based upon this best matched selection, the facial features and characteristics of the person can be placed upon the model (avatar), for natural characteristics (abstract).”

Applicants respectfully disagree.

Maurer uses the model graph to find a human face based on the best matched selection, whereas applicants use the demographic classification on the already found face image to select an approximate three dimensional face model.

Although based on the best matched selection, the facial features can be used for the avatar creation; Maurer does not teach the usage the demographic classification on the already found face image to select an approximate three dimensional face model.

For further clarification, the processes of Maurer and applicants' system are compared as follows:

The order of the process and teaching in (Maurer, col. 5, lines 29-46) is as follows:

- (1) **Definition of a bunch graph:** "To represent a face, a data structure called a bunch graph 70 (FIG. 6) is used. It is similar to the graph described above, but instead of attaching only a single jet to each node, a whole bunch of jets 72 (a bunch jet) are attached to each node. Each jet is derived from a different facial image." (Maurer, col. 5, lines 29-33)
- (2) **Process to form a bunch graph:** "To form a bunch graph, a collection of facial images (the bunch graph gallery) is marked with node locations at defined positions of the head. These defined positions are called landmarks." (Maurer, col. 5, lines 33-37)
- (3) **Process of matching a bunch graph to an image:** "When matching a bunch graph to an image, the jet extracted from the image is compared to all jets in the corresponding bunch attached to the bunch graph and the best-matching one is selected. This matching process is called elastic bunch graph matching." (Maurer, col. 5, lines 37-41)
- (4) **Capacity of the bunch graph:** "When constructed using a judiciously selected gallery, a bunch graph covers a great variety of faces that may have significantly different local properties e.g. samples of male and female faces, and of persons of different ages or races." (Maurer, col. 5, lines 41-46)

In addition, the process below also follows:

(5) **Movement of the bunch graph to find best match:** “Again in order to find a face in an image frame, the graph is moved and scaled and distorted until a place is located at which the graph matches best (the best fitting jets within the bunch jets are most similar to jets extracted from the image at the current positions of the nodes).” (Maurer, col. 5, lines 47-51)

Clearly and explicitly, Maurer only teaches about the bunch graph, process to form a bunch graph, process of matching a bunch graph to an image, its capacity for great variety of faces, and process to find the best match in (Maurer, col. 5, lines 29-51). In nowhere, Maurer teaches the race and gender is determined, and a face model specific for the race and gender is chosen as an “approximate face model” for a given set of face images of the person.

In comparison, applicants discussed,

(1) **Face detection and facial feature detection:** “In the exemplary embodiment shown in Figure 2, the system first utilizes tools 202 for face detection and facial feature detection from images 201.” (Applicants’ specification, page 7, lines 15-16)

(2) **Race and gender classification:** “Next, the system utilizes Support Vector Machine (SVM) based race and gender classifiers, 203 and 204, respectively, to determine the race and gender of the person in the images.” (Applicants’ specification, page 8, lines 11-13)

(3) **Approximate face model selection:** “For a given set of face images of the person, the race and gender is determined, and a face model, specific for that sub-class (for example, male-Caucasian is a subclass) is chosen as an approximate face model by the

subsystem 205 in the exemplary embodiment shown in FIG. 2.” in (Applicants’ specification, page 9, lines 1-4 and page 5, lines 5-7).

(4) **Final 3D face modeling:** “In the exemplary embodiment shown in FIG. 2, a simple yet effective, 3D mesh adjustment technique 206 based on some of the fundamental results in 3D computer vision was used.” in (Applicants’ specification, page 9, lines 5-11).

Applicants also discussed, “This demographic classification is then used to select an approximate three dimensional face model from a set of models. Using this initial model and properties of camera projection, the model is adjusted leading to a more accurate face model.” in (Applicants’ specification, abstract, lines 4-7). As the order of the process explicitly teaches, applicants clearly discussed that the race and gender is determined after face detection and facial feature detection for a given set of face images of the person, and then a face model specific for the race and gender is chosen as an approximate face model.

Applicants respectfully emphasize that the difference is significantly non-trivial to those who are familiar with the subject matters in the practiced art.

Not only is Maurer entirely foreign to the idea of determining the race and gender of a person in the images, but also Maurer is entirely foreign to the idea of selecting a face model that is specific to the demographic recognition of the person as an approximate face model.

Combination Of Demographic Recognition With Affine Coordinate Based Mesh Adjustment Technique Face Modeling Is Foreign To Maurer

5. In paragraph 3 of the last O.A., the O.A. noted that “the use of finite element models can be used (col. 13, lines 7-8), which adjusts the model based upon affine coordinates, and in this

case for avatar movement.” and “(col. 9, lines 7-31) where affine transformation is used to create a model with precise shape information. Thus affine transformation is used with the demographic, for precise shape information of the person’s image”.

However, since Maurer is entirely foreign to the idea of determining the race and gender of a person in the images, the idea of combining the demographic recognition with affine coordinate based mesh adjustment technique for the face modeling is further foreign to Maurer. Maurer does not explicitly teach this and there is no suggestion of this combination in Maurer. Therefore, a guessed assumption above, without explicit teachings in Maurer, cannot justify the combination at all.

In fact, Maurer can use the techniques in applicants’ system to improve its model selection, tracking of facial feature, or avatar creation by having more demographic specific approximate face model. However, Maurer itself is clearly foreign to the idea of combining the demographic recognition with affine coordinate based mesh adjustment technique for the face modeling as well as Maurer is foreign to the idea of using a face model that is specific for a demographic class as an approximate face model.

Whereas, applicants explicitly discussed this novel idea in, “For a given set of face images of the person, the race and gender is determined, and a face model, specific for that subclass (for example, male-Caucasian is a subclass) is chosen as an approximate face model by the subsystem 205 in the exemplary embodiment shown in FIG. 2.” (Applicants’ specification, page 9, lines 1-4), and “In the exemplary embodiment shown in FIG. 2, a simple yet effective, 3D mesh adjustment technique 206 based on some of the fundamental results in 3D computer vision was used.” in (Applicants’ specification, page 9, lines 5-11). Maurer is entirely foreign to this.

6. Regarding claim 16, the last O.A. noted applicants to see rejection made to claim 1, as it addresses the rejection to the method of this apparatus.

Applicants amended claim 16, which recites limitations that are similar and in the same scope of the invention as those in claim 1 above.

Therefore, applicants respectfully request reconsideration of the amended claim 16 for the same reasons as stated above in regard to claim 1.

The Dependent Claims Are a Fortiori Patentable Over Maurer

7. Dependent claims 3, 6-7, and 9-12 incorporate all the subject matter of claim 1 and add additional subject matter, which makes them a fortiori and independently patentable over the references.

Applicants amended the claims 3, 6-7, and 9-12 as follows:

8. Regarding claim 3, claim 3 has been canceled.

9. Regarding claim 6, claim 6 further adds, “a step of using affine lines and their slope adjustment, which is proportional to depth of the point, for model estimation.”

Maurer teaches, “In addition to the frontal pose, bunch graphs need to be created only for rotations in depth.” with regard to the “tracking correction” in (Maurer, col. 9, lines 51-57).

Maurer is entirely foreign to the idea of using affine lines and their slope adjustment, which is proportional to depth of the point, for model estimation, in combination with the

selected approximate face model based on the demographic determination (Applicants' specification, page 9, lines 1-4, and page 5, lines 5-15).

10. Regarding claim 7, claim 7 further adds, "a step of using said affine line properties without the need for calibrating the image capturing systems, whereby the image capturing systems include cameras".

Maurer teaches, "Stereo-camera systems are able to perform accurate 3-D measurements when the cameras are fully calibrated (camera parameters are computed through a calibration process)" (Maurer, col. 11, lines 62-65) as a part of the techniques for obtaining the generic face model in (Maurer, col. 11, line 55 – col. 12, line 23). This is contradictory to one of the objectives that the applicants' present invention tries to overcome as discussed in (Applicants' specification, page 3, lines 12-18, and page 4, lines 11-14). Maurer is foreign to this.

11. Regarding claim 9, claim 9 further adds, "a step of using the affine line properties for re-projecting a matched pair in two images to a third image, once four facial landmarks are located in all of the three images".

Maurer teaches the "elastic bunch graph matching" using "a whole bunch of jets" in (Maurer, col. 5, lines 29-46). In order to form a bunch graph, "a collection of facial images (the bunch graph gallery) is marked with node locations at defined positions of the head. These defined positions are called landmarks." in (Maurer, col. 5, lines 34-37). Then, "When matching a bunch graph to an image, the jet extracted from the image is compared to all jets in the

corresponding bunch attached to the bunch graph and the best-matching one is selected.”

(Maurer, col. 5, lines 37-40).

Maurer defines the jets in “The jets are composed of wavelet transforms that are processed at node or landmark locations on an image corresponding to readily identifiable features.” (Maurer, col. 3, lines 3-5).

The “elastic bunch graph matching” and the usage of “landmarks” for the matching processing in (Maurer, col. 5, lines 29-46) is clearly different from the idea of re-projecting a matched pair in two images to a third image, once four facial landmarks are located in all three images using affine line properties, as discussed in “Once the facial landmarks are identified across the images, the depth of an arbitrary point in the face mesh is changed continually and reprojected to all views (following paraperspective camera projection properties). The depth value for which a successful match is obtained across views is chosen. This is repeated for a dense set of points on the face.” (Applicants’ specification, page 5, lines 11-15). Therefore, Maurer is foreign to this.

12. Regarding claim 10, claim 10 further adds, “a step of using a single view to crudely model the face based on gender and ethnicity and then use anthropometric measures for identification”.

Since Maurer is entirely foreign to the idea of determining the race and gender of a person in the images as discussed above, Maurer is further foreign to this.

13. Regarding claim 11, claim 11 further adds, “a step of using multiple views to model the face in the image based on the combination of the demographics and the affine line properties and then use the anthropometric measures for identification purposes”.

Since Maurer is entirely foreign to the idea of determining the race and gender of a person in the images as discussed above, Maurer is further foreign to this.

14. Regarding claim 12, claim 12 has been canceled.

15. Dependent claims 17, 19-21, and 23-26 incorporate all the subject matter of claim 16 and add additional subject matter, which makes them a fortiori and independently patentable over the references.

Applicants amended the claims 17, 19-21, and 23-26 as follows:

16. Regarding claim 17, claim 17 further adds, “a hardware system consisting of disparate cameras at disparate locations, images from which are used for said face modeling, whereby usages of the disparate cameras comprise multiple processing of the face modeling for multiple users”.

Since Maurer is entirely foreign to the idea of determining the race and gender of a person in the images as discussed above, Maurer is further foreign to the idea of using disparate cameras for determining the race and gender of a person in the images for the face modeling.

17. Regarding claim 19, claim 19 has been canceled.

18. Regarding claims 20, 21, 23, 24, and 25, the last O.A. noted applicants to see rejection made to claims 6, 7, 9, 10, and 11, respectively, as the claims 6, 7, 9, 10, and 11 address the rejections to the methods of the apparatus in claims 20, 21, 23, 24, and 25, respectively.

Applicants amended claims 20, 21, 23, 24, and 25, which recite limitations that are similar and in the same scope of invention as to those in claims 6, 7, 9, 10, and 11, respectively, above. Therefore, applicants respectfully request reconsideration of the amended claims 20, 21, 23, 24, and 25, for the same reasons as stated above in regards to claims 6, 7, 9, 10, and 11, respectively.

19. Regarding claim 26, claim 26 has been canceled.

20. Accordingly applicants submit that the dependent claims are a fortiori patentable and should also be allowed.

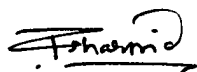
CONCLUSION

For all the above reasons, Applicants submit that the specification and claims are now in proper form, and that the claims all define patentably over the prior art. Therefore they submit that this application is in condition for allowance now, which action they respectfully solicit.

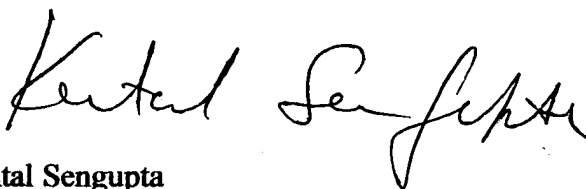
Conditional Request for Constructive Assistance

Applicants have amended the specification and claims of this application so that they are proper, definite, and define novel structure, which is also unobvious. If, for any reason this application is not believed to be in full condition for allowance, Applicants **very respectfully request** the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. § 2173.02 and § 707.07(j) in order that the undersigned can place this application in allowable condition.

Very respectfully,



Rajeev Sharma



Kuntal Sengupta

-----Applicants Pro Se-----

403 South Allen Street, Suite 101

State College, PA 16801

Tel. (814) 867-8977; Fax (814) 867-8957

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